1   **MULTI-FUNCTIONAL PORT**

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3   This application claims the benefit of United States Provisional Application, entitled " Multi-

4   Functional Port", filed on July 22, 2003.

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6   BACKGROUND OF THE INVENTION

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8   FIELD OF THE INVENTION

9   **[0001]**   The present invention is related to electrical interfaces, more particularly it relates to a

10   multi-protocol electrical interface.

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12   DESCRIPTION OF THE PRIOR ART

13   **[0002]**   Serial communications, synchronous or asynchronous are typically defined by

14   standards, such as those set by the Electronic Industries Association/Telecommunications

15   Industry Association (EIA/TIA). These standards define interfaces such as, but not limited to,

16   EIA/TIA-232, EIA/TIA-449, EIA/TIA-530, and EIA/TIA-530A, which are also well known in

17   the industry under the former EIA prefix "RS-" (Recommended Standard) as RS-232, RS-449,

18   RS-530, and RS-530A. Additional interfaces include International Telecommunications Industry

19   .(ITU) X.21 and V.35. Also, the Institute of Electrical and Electronics Engineers (IEEE) 1284

20   standard define interfaces for parallel communications. These standards define communication

21   protocols, signal levels, maximum bandwidth, connector pin-out, supported handshaking signals,

22   drive capabilities, and electrical characteristics of the serial or parallel lines for data exchange.

23   **[0003]**   Typically, each serial interface operates either as a data terminal equipment (DTE) or

24   a data circuit-terminating equipment (DCE). Typically, a terminal or computer is referred to as

25   the DTE and a modem is typically referred to as the DCE. A signal that is an output on a DTE is

26   the input to a DCE on the opposite end of the serial interface. Generally, the DTE and the DCE

27   have complementary mechanical connectors, which can be coupled to allow an interchange of

28   binary signals between the electrical interface standards in the industry. With the abundance of

29   interface standards in use it is difficult to design DTEs that will interconnect with the wide range

1   of available DCEs. Most existing DTE interconnection devices only support a single type of

2   interface. In order to perform the data exchange according to the selected protocol it is necessary

3   to establish a number of electrical connectors having predetermined characteristics. Typically

4   this is done by a mechanical connector having a defined configuration of pins, e.g. a RS 232 DB-

5   9 connector with 9 pins or a DB 25 with 25 pins.

6   [0004]   Several attempts have been made to develop a DTE interface that will support

7   multiple interface standards.

8   [0005]   In other DTEs and DCEs, this problem is solved by having a separate cable for each

9   of the interface standards and by routing the signals, depending upon which standard is being

10   used, to a corresponding receiver or set of receivers. In this example, a common connector is

11   used at the interchange interface and has a group of pins dedicated to signals that are unique to

12   each interface standard. This method, however, requires larger connector space.

13   [0006]   Another solution has been to include a number of interface boards in the DTE or

14   DCE, each board corresponding to a particular electrical interface standard. These boards remain

15   available at all times so that they may be switched into and out of the respective DTE or DCE

16   depending upon which electrical interface standard is being implemented at that time. When not

17   in use these boards are left idle or are removed and can be easily lost or damaged.

18   [0007]   Therefore, these solutions require additional hardware that can be easily misplaced

19   and needs to be at an arm's length to cater for the different application environments. Also, there

20   is substantial time expended configuring the DTE to the DCE. Some devices use a single

21   connector to accommodate all the different possible industry interfaces; however, this makes for

22   a rather bulky and expensive connector. These proposed solutions are not ideal for portable or

23   handheld computers, where portability, flexibility and a minimum footprint are most desirable.

24   These hand-held computers may be used in harsh environments such as industrial plants where

25   there could be hazardous materials or measurements performed in confined spaces, and the

26   connectors must withstand the physical conditions imposed by these environments. The cost of a

27   ruggedised, large connector is prohibitive.

28   [0008]   It is therefore an object of this invention to mitigate or obviate at least one of the

29   above-mentioned disadvantages.

1 SUMMARY OF THE INVENTION

2 [0009] In one of its aspects the present invention provides DTE comprising

3 a port;

4 at least one signal line connected to said port to establish a communication path;

5 a set of transceivers, each associated with a respective circuit in said DTE to establish

6 communication along said communication path in accordance with a selected protocol;

7 a switch in each of said signal lines, each of said switches having a set of connections

8 with each of said connections associated with a respective one of said transceivers; and

9 a control signal to condition said switches to connect all of said signal lines with a

10 connection associated with a selected one of said transceivers

11 [0010] In another aspect of the invention of the invention, there is provided an interface

12 system for coupling a plurality of signals between a DTE and a DCE via a plurality of

13 communication paths, said system having:

14 a DTE port having at least one signal line to establish one of said plurality of

15 communication paths, said DTE having a ser of transceivers each associated with a respective

16 circuit in said DTE to establish communication along said communication path in accordance

17 with a selected protocol;

18 a DCE port having at least one signal line to establish one of said plurality of

19 communication paths, said DTE having an interface driver circuit to establish communication

20 along said communication path in accordance with said selected protocol;

21 a switch in each of said signal lines, each of said switches having a set of connections

22 with each of said connections associated with a respective one of said transceivers; and

23 a control signal to condition said switches to connect all of said signal lines with a

24 connection associated with a selected one of said transceivers.

25 [0011] Advantageously, the number of connector pins is minimised, as none of the connector

26 pins are dedicated to a particular electrical interface standard or to individual signals. Therefore,

27 the connector is less expensive, easier to manufacture, more robust and thus ideal for handheld

28 devices that need to accommodate peripheral devices having various electrical interfaces.

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1 BRIEF DESCRIPTION OF THE DRAWINGS

2 [0012]   These and other features of the preferred embodiments of the invention will become

3 more apparent in the following detailed description in which reference is made to the appended

4 drawings wherein:

5 [0013]   Figure 1 is a perspective view of a hand held scanner and peripheral device;

6 [0014]   Figure 2 is a schematic representation of a communication network; and

7 [0015]   Figure 3 is a schematic diagram of an interface system.

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9 DESCRIPTION OF THE PREFERRED EMBODIMENTS

10 [0016]   Referring to Figure 1, a hand held scanner 12 has a body 4 with a keypad 6 and a

11 scanner window 8. The scanner 2 is used to collect information by scanning bar codes and the

12 like and subsequently transfer such information to a peripheral device 14, such as a printer. Data

13 is transferred over a communication system 10 shown in more detail in Figures 2 and 3.

14 Communications network 10 has a data terminal equipment (DTE) 12 embodied in the scanner 2,

15 and a data circuit-terminating equipment (DCE) 14 embodied in the peripheral 14

16 communicatively coupled to each other via an interface system 13. The DTE 12 may be a

17 computer, a handheld device or a laptop computer, while the DCE 14 may be one of a number of

18 devices such as a printer or a modem. An example of a handheld device operating as a DTE 12

19 is a Model No. 7535 Hand-Held computer from Psion Teklogix of Mississauga, Ontario, Canada.

20 Generally, a DTE 12 includes a computer readable medium with instructions, data and an

21 operating system, input and output means, and a processor for executing the instructions.

22 [0017]   The data is transferred between the DTE 12 and respective ones of the DCE 14

23 according to a predetermined communication protocol through the DTE electrical interface 16 or

24 port, and the port 18 of the DCE 14. Typically, the communication protocol is defined by a

25 standards body such as the Electronic Industries Association/Telecommunications Industry

26 Association (EIA/TIA), whose standards define electrical interfaces such as EIA/TIA-232,

27 EIA/TIA-449, EIA/TIA-530, and EIA/TIA-530A. Each of the DCE's 14 may utilize a different

28 standard or may require a different set of signals even if using the same protocol so that the

29 number of interfaces typically corresponds to the number of DCEs that may be used.

1   [0018]   In practice, however, the number of connectors required is typically less than that

2   specified in the standard. The DTE port 16 and DCE port 18 are provided with complementary

3   male and female connectors, 20, 22, having connector pins 24. The number of pins 24

4   corresponds to the maximum number of connectors required to enable data transfer in

5   accordance with any of the protocols required for the specific set of DCE's. For example, if one

6   of the DCE's implements an EIA 232 protocol and needs only 10 pins and the other DCE's

7   implement RS 232 protocols needing 9 pins, then the maximum number of pins required is 10.

8   [0019]   Each of the pins 24 of the connector 20 is connected to a respective one of a set of bi-

9   directional multiplexers 26. Each of the multiplexers 26 has a set of outputs 27 corresponding to

10   the number of interfaces required plus one for a null position. The outputs are connected

11   selectively to respective ones of a set of transceivers 30 so that each transceiver is connected

12   through the multiplexers 26 to the pins needed to implement the data transfer. Each of the

13   transceivers 30 is configured for a particular interface and connects the multiplexer outputs to

14   circuits within the DTE.

15   [0020]   Each of the multiplexers 26 functions as a multiple position switch having 1 input and

16   n outputs. Selection of the output is performed by a control signal 29 obtained from an interface

17   controller 28. The controller 28 receives an identification signal 31 from a tether identification

18   module 36 in the DCE 14 that uniquely identifies the device and required interface. The data

19   exchange protocol is implemented in the DCE by an interface driver 34 connected to the pins 24

20   of the connector 22.

21   [0021]   The interface driver circuit 34 is based on a particular electrical interface standard for

22   the peripheral interface 18. The interface driver circuit 34 includes transmitters, which accept

23   TTL (transistor-transistor logic) or CMOS (complimentary metal-oxide-semiconductor) inputs

24   and outputs the respective electrical interface standard signals, and the receivers of the interface

25   driver circuit 34 converts electrical interface standard input signals to TTL or CMOS signals.

26   [0022]   Electrical power to the controller 28 and driver 34 is provided by a power controller

27   32.

28   [0023]   Each of the plurality of transceivers 30 is configured to function with a specific

29   electrical interface standard. Generally, each transceiver 30 includes a plurality input and output

1   pins specific electrical interface standard, such as, transmit data pins which provide a parallel

2   data path, a transmit clock, a transmit enable pin, register access pins to provide a bidirectional

3   serial data path, a clock, an interrupt pin for indicating a change in register status. The input or

4   receive pins include receive data pins, receive clock output pin, a valid receive data pin

5   indicating when receive data is presently valid, a receive data error pin, among others.

6   [0024]   Each of the transceivers 30 provides output signals to each of the multiplexers 26,

7   such that an appropriate transceiver 30 is selected by the multiplexers 26 based on the

8   characteristics of the interface driver circuit 34 as indicated by the tether ID signal 29. The tether

9   identification signal 29 generates pins 24 by a selection signal from the interface controller 28,

10   and determines as to which of the plurality of a particular transceiver 30 output signals are to be

11   coupled to the connector.

12   [0025]   In operation, when a DCE interface 16 is coupled to the DTE interface 18, the

13   interface controller 28 detects the presence of a tether ID signal issued by the tether

14   determination module 36. This ID signal indicates the electrical interface standard specific to that

15   external device 14. The tether ID signal is then interpreted by the interface controller 28, which

16   then provides an input channel SELECT control signal to the multiplexers 26 causing each of the

17   multiplexers 26 to select one of its outputs. The appropriate one of the transceivers 30 is then

18   connected through the multiplexers 26 to the pins 24. The other transceivers 30 are isolated.

19   Connectors of a different DCE 14 provide a different identifier signal and selection of a different

20   output for each of the multiplexers 26. When no device is attached to the port 16, the

21   multiplexers 26 select the null pin that properly terminates each of the signal lines.

22   [0026]   The interface system 13 also includes a power controller 32 that controls power to the

23   device 14, by enabling power thereto when that device 14 is attached to the tether port 16 after

24   the appropriate interface routing has been established. The power controller 32 may also

25   minimize power consumption in the DTE 12 in the instance when no device 14 is attached to the

26   tether port 16, by disabling power to the multiplexers 26. The power controller 32 monitors

27   whether the tether port 16 is in use by detecting whether a peripheral device 14 is present, this

28   can be typical achieved by periodically detecting the tether ID signal. Generally, when a

29   peripheral device 14 is not present, the signals at the bi-directional multiplexer 26 inputs or

1   outputs are set to their null connections which, in general, are a connection to ground via an

2   impedance, such that power to the multiplexers 26 is minimized. The detection of a device 14 by

3   the tether identification module 34 causes the interface controller 28 to activate the multiplexers

4   26. However, this feature can be overridden with signals that force the device 14 on or off. This

5   feature is useful, because in many applications peripheral devices 14 are used for only short

6   periods of time, and thus conserves battery power.

7   [0027]   Therefore, there is provided a multi-protocol port 16 capable of interfacing signals

8   conforming to a plurality of the electrical interface standards. The multi-protocol port 16 is

9   coupled to a plurality of selectable circuits, each of said circuits being associated with an

10   electrical interface standard and selectable via a mode-select input signal in order to facilitate

11   communication with a peripheral device coupled to the port 16. Thus, it is seen that a multi-

12   protocol port 16 is presented which can be selectably automatically configured to conform to a

13   plurality of electrical interface standards, and employs a minimum number of connector pins 24.

14   [0028]   Although the invention has been described with reference to certain specific

15   embodiments, various modifications thereof will be apparent to those skilled in the art without

16   departing from the spirit and scope of the invention as outlined in the claims appended hereto.